Selected Patents Related to Thermal Spraying

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US denotes U.S. patent, WO denotes World Organization patent, EP denotes European patent, GB denotes Great Britain patent, RU denotes patent of Russian Union, CZ denotes patent of Czech Republic, CA denotes Canadian patent, and JP denotes Japanese patent. Due to differences in databases, not all data are available for each patent.

Applications

Abrasive Coatings

Process for Producing an Abrasive Coating for Metal Components of Drive Units. Method for the production of a brushing-contact coating for metallic engine components having an abrasive coating, which abrades a shroud coating by brushing contact, the said method being characterized by the following process steps: a perforated mask is positioned over the component surface to be coated; a ceramic material is sprayed through the perforated mask onto the component surface to be coated, at a spraying angle of 10° to 30° to form cutting edges and free spaces.

EP0702130B1. J. Schröder, T. Uihlein, H. Weber, H. Fischer, E. Fischhaber, and N. Legrand. Company: MTU Aero Engines GmbH. Issued/Filed: 23 April 2003/26 Aug 1995.

Aluminum Surface Improvement

Method for Making Aluminum Sheet and Plate Products More Wear Resistant. A method for making an aluminum substrate that is subjected to repeated impaction more wear resistant. The method comprises applying at least about 0.005 in. thick coating of an amorphous composition directly to only portions of this substrate, preferably after it is shaped into a product for transporting consumable materials. The coating composition to which steel, aluminum, PTFE, and/or polyethylene may be added can be thermally sprayed to the substrate surface.

US6551664. R.W. Kaufold, N.C. Whittle, and D.D. Roup. Company: Alcoa Inc., Pittsburgh, PA. Issued/Filed: 22 April 2003/28 Feb 2001.

Antimicrobial Coatings

Anti-Microbial Powder Coatings. Improved powder coatings exhibit enhanced resistance to bacterial and fungal attack, while possessing excellent toughness, appearance, corrosion resistance, durability, processibility, and ease of application. The coating comprises antimicrobial agents that are homogeneously dispersed within the powder or impact fused to powder particles or both. An article may be coated with a thermoset thermoplastic, or radiation curable powder, which may be applied by electrostatic spray or fluidized bed or by thermal or flame spray.

US20030096017A1. O.H. Decker, M.A. Sparks, J.R. Hagerlin, F.L. Cummings, and P. Gottschling. Issued/Filed: 22 May 2003/28 June 2002.

Beryllium Brazing

Method of Brazing Beryllium-Aluminum Alloy Members to Form a Beryllium-Aluminum Alloy Assembly and Coating the Beryllium-Aluminum Alloy Assembly. A method for brazing beryllium-aluminum alloy members to form a beryllium-aluminum alloy assembly and coating the beryllium-aluminum alloy assembly in which an aluminum-silicon-base braze alloy is placed between the beryllium-aluminum members at the locations for forming braze joints. The aluminum-silicon-base braze alloy is surrounded by a brazing flux comprising aluminum fluoride. The beryllium-aluminum alloy members and the aluminum-silicon based braze alloy are heated to form the beryllium-aluminum alloy assembly. Oxidized surfaces appearing on the beryllium-aluminum alloy members are removed. Thereupon, the beryllium-aluminum alloy assembly is coated by plasma deposition of alumina-titania powder.

US6543678. J.L. Emmons and R. Hardesty. Company: The Peregrine Falcon Corp., Pleasanton, CA. Issued/Filed: 8 April 2003/29 Sept 1997.

Bond Coats

Re Alloy Coating for Diffusion Barrier. A rhenium alloy coating for a diffusion barrier applied to a substrate, characterized in that it contains rhenium in an atomic percentage not less than 30% and less than 90%, at least one element selected from chromium, molybdenum, and tungsten in a total atomic percentage of not less than 5% and less than 60%, and at least one element selected from nickel, iron, and cobalt, and inevitable impurities in the balanced percentage. A layer having a desired alloy composition can be formed on the barrier coating by the surface coating method or through the diffusion of a component of the substrate, and when the barrier coating is subjected to a homogenization heat treatment and thereafter a cementation layer containing at least one element of aluminum, silicon, and chromium is laminated on the barrier coating, none of these elements substantially diffuses. Further, a stress-relaxing layer comprising an alloy containing rhenium can be inserted between the substrate and the barrier coating. The rhenium alloy barrier coating allows the suppression of the deterioration of a substrate and a corrosion-resistant coating layer due to the reaction of the substrate and the coating layer, which has conventionally been a severe problem in the field of corrosion-resistant coatings, such as a ceramic coating for heat shielding on a substrate made of, for example, a nickel-base alloy, aluminum (or chromium or silicon) pack cementation, thermal spraying, and the like, and thus allows the increase of the life of a device.

WO3038152A1. T. Narita, S. Hayashi, T. Yoshioka, and H. Yakuwa. Company: Japan Science and Technology Corp., Saitama, Japan and Ebara Corp., Tokyo, Japan. Issued/Filed: 8 May 2003/13 Sept 2002.

ReCr Alloy Coating for Diffusion Barrier. A ReCr alloy coating for a diffusion barrier applied to a substrate, characterized in that it contains rhenium in an atomic percentage of not less than 50% and less than 90% and chromium and inevitable impurities, essentially chromium, in the balanced content. A layer having a desired alloy composition can be formed on the barrier coating by the surface coating method or through the diffusion of a component of the substrate, and when the barrier coating is subjected to a homogenization heat treatment and thereafter a cementation layer containing at least one element of aluminum, silicon, and chromium is laminated on the barrier coating, these elements do not substan-

tially diffuse. Further, a stress-relaxing layer comprising an alloy containing rhenium can be inserted between the substrate and the barrier coating. The ReCr alloy barrier coating allows the suppression of the deterioration of a substrate and a corrosion-resistant coating layer due to the reaction of the substrate and the coating layer, which has conventionally been a severe problem in the field of corrosion-resistant coatings such as a ceramic coating for heat shielding on a substrate made of, for example, a nickel-base alloy, aluminum (or chromium or silicon) pack cementation, thermal spraying and the like, and thus allows the increase of the life of a device.

WO3038150A1. T. Narita, S. Hayashi, T. Yoshioka, and H. Yakuwa. Company: Japan Science and Technology Corp., Saitama, Japan and Ebara Corp., Tokyo, Japan. Issued/Filed: 8 May 2003/13 Sept 2002.

ReCrNi Alloy Coating for Diffusion Barrier. A ReCrNi alloy coating for a diffusion barrier applied to a substrate, characterized in that it is essentially a three-component alloy and contains rhenium, chromium, and nickel in atomic percentages of 20 to 80%, 20 to 60%, and 5 to 40%, respectively, and inevitable impurities in the balanced percentage. A layer having a desired alloy composition can be formed on the barrier coating by the surface coating method or through the diffusion of a component of the substrate, and when the barrier coating is subjected to a homogenization heat treatment and thereafter a cementation layer containing at least one element of aluminum, silicon, and chromium is laminated on the barrier coating, none of these elements substantially diffuses. Further, a stress-relaxing layer comprising an alloy containing rhenium can be inserted between the substrate and the barrier coating. The ReCrNi alloy barrier coating allows the suppression of the deterioration of a substrate and a corrosion-resistant coating layer due to the reaction of the substrate and the coating layer, which has conventionally been a severe problem in the field of corrosion-resistant coatings such as a ceramic coating for heat shielding on a substrate made of, for example, a nickel-base alloy, aluminum (or chromium or silicon) pack cementation, thermal spraying, and the like, and thus allows the increase of the life of a device.

WO3038151A1. T Narita, S. Hayashi, T. Yoshioka, and H. Yakuwa. Company: Japan Science and Technology Corp., Saitama, Japan and Ebara Corp., Tokyo, Japan. Issued/Filed: 8 May 2003/13 Sept 2002.

A Refractory Furnace Block With a Surface Coated in a Platinum Alloy. A ReCrNi alloy coating for a diffusion barrier applied to a substrate, characterized in that it is essentially a three-component alloy and contains rhenium, chromium, and nickel in atomic percentages of 20 to 80%, 20 to 60%, and 5 to 40%, respectively, and inevitable impurities in the balanced percentage. A layer having a desired alloy composition can be formed on the barrier coating by the surface coating method or through the diffusion of a component of the substrate, and when the barrier coating is subjected to a homogenization heat treatment and thereafter a cementation layer containing at least one element of aluminum, silicon, and chromium is laminated on the barrier coating, none of these elements substantially diffuses. Further, a stress-relaxing layer comprising an alloy containing rhenium can be inserted between the substrate and the barrier coating. The ReCrNi alloy barrier coating allows the suppression of the deterioration of a substrate and a corrosion-resistant coating layer due to the reaction of the substrate and the coating layer, which has conventionally been a severe problem in the field of corrosion-resistant coatings such as a ceramic coating for heat shielding on a substrate made of, e.g., a nickel-base alloy, aluminum (or chromium or silicon) pack cementation, thermal spraying, and the like, and thus allows the increase of the life of a device.

GB2382641A. D.R. Coupland and P.M. Williams. Company: Johnson Matthey PLC, Great Britain. Issued/Filed: 4 June 2003/28 Nov 2001.

Bondcoat for Elastomers

Elastomer-Covered Roller Having a Thermally Sprayed Permeable Bonding Material. An elastomer-covered roller is provided with an improved bond coating for bonding the elastomeric cover to the core. At least one layer of material is thermally sprayed on the core to form a rough surface having a roughness from 400 to 2000 μin. R_a or greater. At least one layer is either sufficiently permeable to divert bond-degrading fluids away from the bond line or is impermeable to bond-degrading fluids.

US20030106217A1. P.J. Kaprelian, G.S. Butters, and B.E. Hyllberg. Issued/Filed: 12 June 2003/15 Jan 2003.

Brake Shoes

Drum Brake Linings Having Thermally or Mechanically Applied Metallic Shoe Attachment Enhancements. Drum brake linings having an integral surface texture on the friction side surface of a drum brake shoe are described. The surface texture may be achieved by spraying metal droplets onto the surface, fusing a metal pattern onto the surface, or creating a series of protrusions by scraping or cutting the surface. The surface textures have excellent shear strength and retention profiles.

WO3027530A1. S.K. Kesavan, K. Fairless, and R. Eastham. Company: Honeywell International Inc., Morristown, NJ. Issued/Filed: 3 April 2003/25 Sept 2002.

Component Restoration

Restoration of Thickness to Load-Bearing Gas Turbine Engine Components. A method for restoring thickness to load-bearing components of gas turbine engines and for repairing a honeycomb structured gas turbine engine component. A surface of the component such as the backing surface of a honeycomb component after honeycomb removal is roughened and cleaned. A selected buildup material is deposited onto the substrate by high-velocity oxyfuel deposition or low-pressure plasma spray. The component is heat treated to enhance the bond between the deposited material particles and between the deposited material and the substrate by diffusion.

US6571472. T.F. Berry, M.J. Weimer, D.E. Budinger, J.D. Dietz, M.D. Gorman, and M. Stewart. Company: General Electric Co., Schenectady, NY. Issued/Filed: 3 June 2003/14 Aug 2001.

Conductors

Method and Device for Producing an Electrical Strip Conductor on a Substrate. The invention relates to a method and a device for producing an electrical strip conductor, especially a surface heat conductor, on a substrate. According to the invention, an electroconductive material is sprayed onto the substrate, by means of thermal spraying, preferably by means of plasma spraying, using a torch, the torch and the substrate being displaceable in relation to each other. The geometric form or the longitudinal direction of the strip conductor produced and/or the electroconductivity of said strip conductor can be topically varied by adapting the spraying parameters and/or the relative

speed or direction of the torch in relation to the substrate and vice versa in a targeted manner during the spraying process.

WO3049500A2. K. Wermbter, A. Killinger, C. Li, W. Hinreiner, and R. Gadow. Company: Schott Glas, Mainz, Germany, Carl-Zeiss-Stiftung, Mainz, Germany. Issued/Filed: 12 June 2003/20 Nov 2002.

Connecting Rod Eye

Method for Producing a Connecting Rod Eye. In the particular embodiments described in the specification, bearing material is applied to the bearing surface of a connecting rod eye by thermal spraying of the bearing material such as by plasma coating. In a particular embodiment, the large connecting rod eye is plasma coated with an aluminum bronze. After the plasma coating, the connecting rod eye is opened by removing the bearing cover from the rest of the connecting rod, thereby breaking the plasma layer. Subsequently, the cover is screwed on again, and the surface of the bearing layer is finished by fine spindling. The method results in reduced assembly costs.

US6560869. U. Schlegel and R. Vogelsang. Company: Volkswagen AG, Germany. Issued/Filed: 13 May 2003/3 March 1998.

Corrosion Protection

Aluminum Alloy Exterior Coating for Underground Ductile Iron Pipe. A corrosion-resistance treatment for ductile iron pipe placed in corrosive environments provides a corrosion-resistant coating from an aluminum-silicon alloy that is applied by thermal spraying or arc spraying onto the material. The alloy contains 88% Al and 12% Si by weight. The aluminum provides corrosion resistance due to cathodic action and protects the pipe even when the coating is damaged. The silicon in the alloy provides greater strength to the otherwise malleable aluminum coating to resist damage to the coating during shipping, handling, and installation.

US6554992. H.W. Smith. Company: McWane Inc., Provo, UT. Issued/Filed: 29 April 2003/7 June 1995.

Cylinder Surfaces

Surface Layer Forming a Cylinder Barrel Surface, a Spraying Powder Suitable Therefor and a Method of Creating Such a Surface Layer. A surface layer for forming a cylinder barrel wall of a combustion engine block is proposed. The surface layer has separate phases of components that are separated from the phase of the remaining materials. The surface layer is produced by plasma spraying an iron-containing spraying powder, incorporating all components of the layer to be produced. Such a surface layer may be applied easily and shows a significantly improved behavior regarding the machining thereof, without negatively influencing other important characteristics of the layer material, such as wear resistance and coefficient of friction vis-à-vis the material of the piston rings. Preferred components of the spraying powder are—besides iron—chromium, manganese, sulfur, and carbon. Moreover, the spraying powder can contain arsenic, tellurium, selenium, antimony, and/or bismuth.

US6578539. Gerard Barbezat. Company: Sulzer Metco AG, Wohlen, Switzerland. Issued/Filed: 17 June 2003/15 May 2001.

Donor Rolls

Donor Roll Coatings. A toner donor roll for use in a development apparatus of an electrophotographic apparatus is disclosed. The donor roll includes a conductive core and a ceramic outer coating over the conductive core. The ceramic coating is formed by thermal spraying a single homogeneous powder consisting of particles, each of which contains a specific ratio of pure alumina and pure titania held together with an organic binder.

EP1308795A2. J.L. Longhenry and M.L. Schlafer. Company: Xerox Corp. Issued/Filed: 7 May 2003/30 Oct 2002.

Structures and Methods for Damping Tool Waves Particularly for Acoustic Logging Tools. A toner donor roll for use in a development apparatus of an electrophotographic apparatus is disclosed. The donor roll includes a conductive core of a ceramic outer coating over the conductive core, the ceramic coating formed from thermal spraying a single homogeneous powder consisting of particles, each of which contains a specific ratio of pure alumina and pure titania held together with an organic binder.

CA2410168AA. E. Cengiz, C.H. Straub, L. Reid, P. Campanac, J.B. Aron, R.D. Joyce, J.A. Pabon, C.-J. Hsu, D. Grigor, and R.M. D'angelo. Company: Schlumberger Canada Limited, Canada. Issued/Filed: 6 May 2003/29 Oct 2002.

Electrodes

Arrangement of an Electrode, Method for Making Same, and Use Thereof. A device of an electrode is disclosed, comprising a core and a surface coating of electrically conductive material, and it is characterized by the fact that the surface coating comprises one or several layers with a pore-free surface, each with a thickness of 0.005 to 0.050 mm and formed by spraying, especially with a vacuum plasma spray technique.

WO3038155A1. A. Mundheim and L. Kroknes. Company: ORO AS, Nesttun, Norway. Issued/Filed: 8 May 2003/8 Oct 2002.

Engine Blocks

Cast Aluminum Part Having a Casting Surface. A cylinder block of an internal combustion engine has several cylinder bores. The surfaces surrounding the cylinder bores have wear-resistant coatings that closely reproduce the surfaces. The coatings are formed by plasma vacuum deposition.

US6555241. H.W Erbsloh, J.F. Feikus, E. Lugscheider, F. Loffler, and C. Wolff. Company: Vaw Motor GmbH, Bonn, Germany. Issued/Filed: 29 April 2003/27 Oct 2000.

Coating for the Working Surface of the Cylinders of Combustion Engines and a Method of Applying Such a Coating. Ferrous coatings of the cylinder working surfaces of combustion engine blocks have a content of bound oxygen in the amount of between 1 to 4 wt.%. They are characterized by extraordinary properties as far as tribology and the possibility of processing, for example, machining, are concerned. Particularly, the coefficient of friction and the tendency to scuffing are substantially reduced. Such coatings can be realized, for example, by adding an amount of 200 to 1000 normalized liters air per minute during the plasma spraying operation.

US6548195. G. Barbezat. Company: Sulzer Metco AG, Wohlen, Switzerland. Issued/Filed: 15 April 2003/29 Dec 1999.

Masking for Engine Blocks for Thermally Sprayed Coating and Method of Masking Same. A masking for an engine block to be thermally sprayed with a coating includes a head deck mask portion adapted to engage a head deck of an engine block to prevent overspray of a thermally sprayed coating on the head deck. The masking also includes a crankcase

mask portion adapted to be disposed in a crankcase chamber of the engine block and engage a lower end of a cylinder bore cavity of the engine block to prevent overspray of the thermally sprayed coating into the crankcase chamber.

EP1077090A3. B.E. Shepley, K.R. Bartle, O.O. Popoola, P.J. Hilton, and R.E. Dejack. Company: Ford Global Technologies Inc. Issued/Filed: 28 May 2003/10 Aug 2000.

Method of Applying a Ferrous Coating to a Substrate Serving as a Cylinder Working Surface of a Combustion Engine Block. To improve the machining and processing, respectively, as well as the tribologic properties of ferrous coatings for the working surfaces of combustion engine cylinder blocks applied by a plasma spraying operation, a ferrous coating having a content of bound oxygen in the amount of between 1 to 4 wt.% is suggested. Such coatings can be realized, for example, by adding an amount of 200 to 1000 normalized liters air per minute during the plasma spraying operation.

US6572931. G. Barbezat. Company: Sulzer Metco AG, Wohlen, Switzerland. Issued/Filed: 3 June 2003/23 Oct 2001.

Method of Producing Thermally Sprayed Metallic Coating. The cylinder walls of light metal engine blocks are thermally spray coated with a ferrous-based coating using an HVOF device. A ferrous-based wire is fed to the HVOF device to locate a tip end of the wire in a high-temperature zone of the device. Jet flows of oxygen and gaseous fuel are fed to the high-temperature zone and are combusted to generate heat to melt the tip end. The oxygen is oversupplied in relation to the gaseous fuel. The excess oxygen reacts with and burns a fraction of the ferrous-based feed wire in an exothermic reaction to generate substantial supplemental heat to the HVOF device. The molten/combusted metal is sprayed by the device onto the walls of the cylinder by the jet flow of gases.

US20030113472A1. L.E. Byrnes, M.S. Kramer, and R.A. Neiser. Issued/Filed: 19 June 2003/13 Dec 2001.

Engine Components

Plastics Composite Material I.C. Engine Component, e.g. of an Intake Manifold, With Metallic Noise-Damping Layer. The component, for example, a throttle body adapter, has a shell formed integrally or in two parts from a plastics composite material, for example, glass-filled nylon. The inner cavity of the shell allows air passage to the engine. In order to damp noise emitted by the component, the exterior surface is coated with a metallic damping layer, for example, of zinc or aluminum, for example, by a thermal spray casting process to a thickness of 0.5 to 4.0 mm. The damping layer may be applied selectively by masking so that certain regions, for example, flange and apertures, are not coated. The invention contributes to reducing NVH.

GB2383085A. J.J. Kempf. Company: Visteon Global Technologies Inc.. Issued/Filed: 18 June 2003/22 July 2002.

Hardfacing

Method for Applying Hardfacing Material to a Steel Bodied Bit and Bit Formed by Such Method. A graphite or silicate plug is coated with a refractory metal and positioned in the cutter pocket of a steel bodied bit as molten hardfacing material is applied to the bit surface under high-temperature conditions. The refractory metal cooperates with the hardfacing material to act as a wetting agent that draws the hardfacing material into intimate contact with the body of the displacement plug. The plug is removed, leaving a composite pocket opening formed by the steel body and the hardfacing material. A PDC cutter inserted into the composite pocket opening closely adheres to the sides of the opening to reduce the gap between the cutter and the hardfacing material to hereby minimize the effects of erosion in the area of the gap. The wetting material on the displacement plug permits the hardfacing material to flow into and remain in position immediately adjacent the displacement body and in the small surface area between adjacent cutter pockets. The hardfacing material also cooperates with the-steel pocket to increase the surface area of the pocket recess that provides additional structural support to the cutter to improve the stability and retention of the cutter in the bit. The refractory metal may preferably be molybdenum that is applied in a thin layer deposited by a plasma coating technique directly over the body of the graphite displacement body.

US6568491. O. Matthews III and D.P. Miess. Company: Halliburton Energy Services Inc., Houston, TX. Issued/Filed: 27 May 2003/4 June 2001.

High-Temperature Material

High-Temperature Strength Member. A high-temperature strength member comprises a substrate of nickel-base single-crystal alloy or a nickel-base unidirectional solidified alloy and a coating of a boron-containing alloy having a specified boron content formed on the surface thereof by a spraying process or a vapor deposition process.

EP1308535A1. M. Okazaki, Y. Harada, and T. Suidzu. Company: Tocalo Co. Ltd. Issued/Filed: 7 May 2003/1 Aug 2000.

Insulating Coating

Composite Heat Insulating Coating. A thermally insulating composite coated layer for the inner surface of the container for liquid metal is composed of thermally sprayed cermet layer, adhered vacuum reflecting layer, coated layer, thermal insulating plate, and refractory layer. Its advantages are thin thickness and high thermal insulating effect.

CN1407031A. J. Ke, China. Issued/Filed: 2 April 2003/9 Sept 2001.

Insulation

Method for Producing a High-Quality Insulation for Electric Conductors or Conductor Bundles of Rotating Electrical Machines by Means of Thermal Spraying. The process according to the invention discloses production of a high-quality insulation for conductors or conductor bundles. In this process, internal corona-discharge protection, insulation, and external corona-discharge protection are all applied to the conductor or conductor bundle in successive steps by means of thermal spraying. The application thickness per spraying run is up to 0.2 mm, thus ensuring that the layer is free of defects and therefore avoiding partial discharges. Moreover, the ability to withstand thermal loads is considerably improved by the use of high-temperature plastics with fillers comprising inorganic materials as coating powder.

US20030113465A1. T. Baumann and R. Fried, Nussbaumen, Switzerland. Issued/Filed: 19 June 2003/17 Oct 2002.

Light-Emitting or Electron-Emitting Devices

Structure and Fabrication of Device, Such as Light-Emitting Device or Electron-Emitting Device, Having Getter Region. A light-emitting device is provided with getter material that can readily be distributed in a relatively uniform manner across the device's active light-emitting portion. An electron-emitting device is similarly provided with getter material

that can readily be distributed relatively uniformly across the active electron-emitting portion of the device. Techniques such as thermal spraying, angled physical deposition, and maskless electrophoretic/dielectrophoretic deposition can be utilized in depositing the getter material.

WO2065499C2. C.J. Curtin, D.A. Haven, T.S. Fahlen, G.B. Hopple, L.S. Pan, I.L. Maslennikov, M.J. Nystrom, J.G. Liu, R.S. Gluck, T. Kosugi, J.C. Dunphy, and D.L. Morris. Company: Candescent Intellectual Property Services Inc., and Sony Corp., Japan. Issued/Filed: 24 April 2003/24 Oct 2001.

Molds

Process for the Production of Molds for Synthetic Resin Molding. There is disclosed a process for producing a mold for synthetic resin molding. The mold has a main body, which is formed by casting, and a molding surface component, which is formed by subjecting the mold main body to thermal spraying treatment and gives a shape to a synthetic resin material. The molding surface component comprises a concave body having a molding surface component with a concave molding surface and an anchor part to prevent detachment of the concave body. The molding surface is subjected to a pre-thermal-spray treatment followed by a plasma thermal spraying treatment to form the concave body. Plasma transfer arc welding is then used to form a raised part that fuses with an edge part of the concave body, which is then machined to form the anchor part. The component, formed by the thermal spraying treatment, comprises a base layer and a surface layer. The pre-thermal-spray treatments include scalping, grinding, machining, including formation of edgeless concave parts, and sandblasting or shortblasting. A movable mold part cooperates with stationary mold to complete the mold.

GB2380704A. N. Yoshitsugu, K. Keiichi, F. Yuuji, and S. Takayuki. Company: Honda Giken Kogyo Kabushiki Kaisha, Japan. Issued/Filed: 16 April 2003/26 May 1999.

Nanomaterials Deposition

Duplex Coatings and Bulk Materials, and Methods of Manufacture Thereof. A contiguous duplex microstructured material comprises a nanostructured material having two structural states, for example, a duplex microstructured coating. One state comprises substantially nanostructured features, while the second state substantially comprises microstructured features. A duplex nanostructured coating can be made by thermal spraying a reconstituted nanostructured material onto a substrate under conditions effective to form a coating comprising more than one structural state.

US20030108680A1. M. Gell, T.D. Xiao, L. Shaw, E. Jordan, and X. Jiang. Issued/Filed: 12 June 2003/9 July 2002.

Optical Fibers

Process and Apparatus for Producing an Optical Fiber Preform by Plasma Deposition

EP1200364B1. J. Goudeau, P. Ripoche, and P. Humbert. Company: Alcatel. Issued/Filed: 25 June 2003/5 June 2000.

Printing Rolls

Roller of Printing Machine Inking Arrangement. The proposed roller of a printing machine inking arrangement, particularly a ductor, is made of a fundamental steel tube; the outer cylindrical jacket is provided with two layers applied thereto by plasma spraying. The substrate layer, which is 0.04 to 0.06 mm thick, is formed of a powder mixture with grain size ranging from 44 to 48 μm and consisting of 95% Ni and 5% Al. The surface layer being 0.15 to 0.25 mm thick is formed of a powder mixture with grain size ranging from 22 to 45 μm and consisting of 87% aluminum oxide and 13% titanium dioxide, and is ground to surface roughness of 0.4 to 0.8 μm. Grain-size indications relate to the state prior the plasma spraying. The ductor surface layer, against which surface a fountain blade bears, is lapped with contact edge of the fountain blade.

CZ0291964B6. M. Sychrovsky. Company: Dobrusske Strojirny A. S., Czech Republic. Issued/Filed: 18 June 2003/19 Jan 1999.

Prosthetic Coatings

Prosthetic Implants Coated with Hydroxylapatite and Process for Treating Prosthetic Implants Plasma-Sprayed With Hydroxylapatite. A method for producing an implant having a coating of at least about 90% by weight of crystalline hydroxylapatite is disclosed. The method comprises of the steps of plasma spraying said implant with hydroxylapatite, placing said implant in a sealable, pressurizable vessel, heating said implant in the presence of steam while in said vessel, cooling said implant; and rinsing said implant with water.

EP0864332B1. B. Story and A. Burgess. Company: Calcitek Inc., Issued/Filed: 28 May 2003/10 Feb 1998.

Pumps

Submergible Pumping System with Thermal Sprayed Polymeric Wear Surfaces. In a pumping system, a PEEK composite material may be applied to wear areas on internal components. Typically, the internal component provides a metallic substrate that is prepared with a metallic bonding layer arc sprayed onto its surface, at least at the wear area. A powderized PEEK composite material is heated and propelled against the substrate and bonding layer by a high-velocity oxyfuel technique. This uniformly coats the substrate providing a durable wear surface for prolonging component life.

US6565257. S.C. Kennedy, T.H.F. Tan, M.L. Taylor, and B.H. Tan, Singapore. Issued/Filed: 20 May 2003/10 Jan 2000.

Repairs of Parts

Method for Correcting Defects in a Workpiece. A method of correcting defects in a metal workpiece. A location of a defect in a workpiece is determined. The defect comprising a void or an inclusion in a workpiece substrate. The workpiece substrate comprises a metal alloy. Material of the workpiece substrate at the location of the defect is removed to form cleaned area in the workpiece substrate. The cleaned area in the workpiece substrate is coated with a high-density coating. A sintering heat treatment is performed on the coated workpiece substrate to remove entrapped gas from the coating material prior to a step of hot isostatic pressing treating. Then, hot isostatic pressing treating is performed on the coated workpiece to produce diffusion bonding between the workpiece substrate and the high-density coating. The material can be removed by techniques such as sandblasting or grinding. A high-density coating process such as hyper-velocity oxyfuel thermal spray process or a detonation-gun process is used to apply the high-density coating to the substrate at the location of the cleaned area. The high-density coating may have the same metal alloy composition as the metal alloy substrate. The metal alloy substrate may comprise a nickel or cobalt-base superalloy, and the high-density coating may have the same nickel or cobalt-base su-

peralloy composition as the metal alloy substrate.

US20030088980A1. J.E. Arnold, New Haven, CT. Issued/Filed: 15 May 2003/ 13 Sept 2002.

Restoration

Combustion Turbine Blade Tip Restoration by Metal Buildup Using Thermal Spray Techniques. A method of repairing the tip region of combustion turbine engine blades is provided. The method includes application of a thermal barrier coating after stripping of the bond coat, repair of the blade, reapplication of the bond coat and suitable heat treatment. Blades that previously were not coated with a thermal barrier coating are candidates for repair with the methods of the present invention.

US20030082297A1. L.W. Wolkers and T.J. Carr. Company: Siemens Westinghouse Power Corp. Issued/Filed: 1 May 2003/26 Oct 2001.

Roller

Nonmarking Web Conveyance Roller and Method of Making Same. A nonmarking web conveyance roller has a generally irregular surface with a plurality of rounded-up features that promote superior venting of entrained air. The surface finish of the roller, formed by a thermal spray process, prevents the formation of impression and honing defects on the conveyed web.

US20030062248A1. G.L. Vannoy, B.S. Rice, F. Ramos, and D.C. Lioy. Company: Eastman Kodak Co. Issued/Filed: 3 April 2003/2 Oct 2001.

Roll Surface

Dewatering Member with a Composite Body for a Paper or Board Machine and Method for Manufacturing a Dewatering Member With a Composite Body for a Paper or Board Machine. A dewatering member for a paper or board machine has a composite body and a hard surface layer. The composite body is manufactured in a pultrusion process. An adhesion layer is formed on desired outer surfaces of the composite body such that reinforcements passed to the adhesion layer have been passed to the pultrusion process through a separate resin bath, to which an adhesion improving agent has been added such that the hard surface layer can be applied directly onto it, and reinforcements forming the inner portion of the composite body have been passed to the pultrusion process through a second resin bath. The composite body is coated with a hard coating layer produced by thermal spraying, and the coating is ground.

EP1316640A2 and US20030106663A1. V.-P. Tarkiainen, L. Muilu, K. Kervinen, and P. Sorsa. Company: Metso Paper Inc. Issued/Filed: 4 June 2003/20 Nov 2002.

Sheet Forming

Method of Manufacturing Aluminide Sheet by Thermomechanical Processing of Aluminide Powders. A powder metallurgical process of preparing a sheet from a powder having an intermetallic alloy composition such as an iron, nickel, or titanium aluminide. The sheet can be manufactured into electrical resistance heating elements having improved room-temperature ductility, electrical resistivity, cyclic fatigue resistance, high-temperature oxidation resistance, low- and high-temperature strength, and/or resistance to high-temperature sagging. The iron aluminide has an entirely ferritic microstructure that is free of austenite and can include, in wt.%, 4 to 32% Al, and optional additions such as 1% Cr, 0.05% Zr, 2% Ti, 2% Mo, 1% Ni, 0.75% C, 0.1% B, 1% submicron oxide particles and/or electrically insulating or electrically conductive covalent ceramic particles, 1% rare earth metal, and/or 3% Cu. The process includes forming a nondensified metal sheet by consolidating a powder having an intermetallic alloy composition such as by roll compaction, tape casting, or plasma spraying, forming a cold-rolled sheet by cold rolling the nondensified metal sheet so as to increase the density and reduce the thickness thereof and annealing the cold-rolled sheet. The powder can be a water, polymer, or gas-atomized powder that is subjected to sieving and/or blending with a binder prior to the consolidation step. After the consolidation step, the sheet can be partially sintered. The cold-rolling and/or annealing steps can be repeated to achieve the desired sheet thickness and properties. The annealing can be carried out in a vacuum furnace with a vacuum or inert atmosphere. During final annealing, the cold-rolled sheet recrystallizes to an average grain size of about 10 to 30 μm. Final stress relief annealing can be carried out in the B2 phase temperature range.

US20030082066A1. M.R. Hajaligol, C. Scorey, V.K. Sikka, S.C. Deevi, G. Fleischhauer, A. Clifton Lilly, and R.M. German, Midlothian, VA. Issued/Filed: 1 May 2003/31 Oct 2001.

Spray Forming

Fabrication of Tooling by Thermal Spraying. A method of making a mold comprising the steps of: (a) providing a matrix having a shape to be molded; (b) depositing a metal on said matrix by spraying the metal as molten droplets from a spray gun by (i) moving the spray gun relative to the matrix so that the spray gun passes back and forth over the surface of the matrix in a movement direction while the metal is ejected from the spray gun in a spray direction, and shifting the gun in a step direction transverse to the movement direction between passes; and (ii) turning the gun between passes so as to change the spray direction between passes so that during at least some successive passes, metal is deposited in the same region of said matrix from two spray directions in a crisscross pattern, whereby the deposited metal forms a shell on the matrix; and (c) removing shell from the matrix.

EP0861145B1. C.P. Covino, E.V. Aversenti, G. Pleasant, and A. Solomon. Company: GMIC Corp. Issued/Filed: 4 June 2003/13 Nov 1996.

Substrates for Assemblies

Substrates with Small Size Metal Oxide Particle Coatings and Microcomponent Assemblies Including the Same. A substrate having a coating of small size metal oxide particles, <5 μm and more particularly <3 μm, formed on the substrate surface and a microcomponent reaction chamber assembly including such a substrate in which the substrate is produced by thermally spraying, plasma spraying, or flame spraying a homogenous particle composition of selected hydroxide, carbonate, nitrate, and hydroxide compositions onto the surface of the metal substrate.

US20030064233A1. T. He, Dublin, OH. Issued/Filed: 3 April 2003/21 Oct 2002.

Thermal Sprayed Electrodes

Thermal Sprayed Electrodes. EP1021583A4. Y. Hui, C. Strock, T. Xiao, P.R. Strutt, and D.E. Reisner. Company: Nanocorp. Issued/Filed: 2 April 2003/9 June 1999.

Thick Alumina Coatings

Aluminum Oxide Based Thick Layers Produced by Plasma Jet Spraying. Al_2O_3 based layers having a total thickness of

more than 0.3 mm are produced on a substrate by plasma jet spraying, said Al_2O_3 based layers having a laminar sandwiched structure wherein at least one Al_2O_3 layer is interpolated between two intermediate layers that are produced by plasma jet spraying as well, said intermediate layers consisting of a ceramic laminated material, which is different from Al_2O_3 and which on cooling increases in volume by phase transition. Preferred materials for said intermediate layers are Al_2O_3 /ZrO_2, Al_2O_3/TiO_2, ZrO_2/Y_2O_3, Y_2O_3/ZrO_2, ZrO_2/MgO, ZrO_2/CeO_2, and ZrO_2/CaO alloy systems.

US6551730. G. Barbezat and S. Zimmermann. Company: Sulzer Metco AG, Wohlen, Switzerland. Issued/Filed: 22 April 2003/7 Aug 2000.

Toner Donor Roll

Alloyed Donor Roll Coating. A toner donor roll for use in a development apparatus of a electrophotographic apparatus is disclosed. The donor roll includes a conductive core of a ceramic outer coating over the conductive core, the ceramic coating formed from thermal spraying a single homogeneous powder consisting of particles, each of which contains a specific ratio of pure alumina and pure titania held together with an organic binder.

US20030086729A1, US6560432, and CA2410197AA. J.L. Longhenry and M.L. Schlafer. Company: Xerox Corp. Issued/Filed: 8 May 2003/5 Nov 2001.

X-Ray Collimator

X-Ray Collimator and Method of Manufacturing an X-Ray Collimator. A method of manufacturing a collimator including providing a platelike body, coating a predetermined portion of a surface of the body with an x-ray absorbing material, and machining at least one collimating slit through the coating and the platelike body. According to one exemplary embodiment, the coating is applied through a thermal spray process. According to another exemplary embodiment, wire electrical discharge machining (EDM) is used to machine the collimating slits. A collimator manufactured in accordance with the presently disclosed method produces precise energy beam cross sections, yet is less expensive to manufacture.

US6556657. A.P. Tybinkowski, R.E. Swain, and M.J. Duffy. Company: Analogic Corp., Peabody, MA. Issued/Filed: 29 April 2003/16 Jan 2001.

Characterization Methods

Porosity Analysis

Method for Preparation of Test Bodies. The invention relates to a method for preparation of test bodies for analysis of porous, preferably thermally sprayed, surface layers, which are incorporated by casting in plastic. The method according to the invention is carried out by placing one or more testpieces of the surface layer in a mold introduced into a vacuum chamber, the pressure of which is lowered, pouring a ready-mixed, liquid casting resin into the mold containing the testpieces, again letting the air into the chamber, lifting the testpieces out of the casting resin and allowing excess of casting resin to drip from the testpieces, and after that they are placed in a mold cavity of a hot molding press, filling said mold cavity together with the testpieces with a pulverized resin, and applying pressure and heat to the mold cavity for a predetermined period of time, whereupon the test body is ready to be taken out and lapped.

US6547998. S.-O. Stanglberg. Company: Volvo Aero Corp., Trollhattan, Sweden. Issued/Filed: 15 April 2003/4 Oct 2000.

Feedstock

Cermet Material

Sprayable Composition. The present invention provides a sprayable composition comprising a ceramic particulate including albite, illite, and quart, and a metallic composition, including nickel, chromium, iron, and silicon. The sprayable composition may be a composite particle, a blend, or a cored wire. The present invention further provides an abradable coating formed on a metal substrate according to a method comprising the step of depositing the abradable coating on the metal substrate by thermal spraying of a sprayable composition comprising a ceramic particulate including albite, illite, and quartz, and metallic composition, including nickel, chromium, iron and silicon. The sprayable composition may be a composite particle, a blend, or a cored wire. The abradable coating may be applied to a metal substrate such as steel, nickel-base alloys, and titanium.

CA2358624AA and WO03031672A1. K. Hajmrle and A.P. Chilkowich. Company: The Westaim Corp., Fort Saskatchewan, Alberta, Canada. Issued/Filed: 10 April 2003/1 Oct 2002.

Liquid Feedstock for Nanoparticles

Nanostructured Feeds for Thermal Spray Systems, Method of Manufacture, and Coatings Formed Therefrom. This invention relates to methods whereby nanoparticle liquid suspensions are used in conventional thermal spray deposition for the fabrication of high-quality nanostructured coatings. Ultrasound is used for disintegration of the as-synthesized particle agglomerates, nanoparticle dispersion in liquid media, and liquid precursor atomization.

US20030077398A1. P.R. Strutt, B.H. Kear, and R.F. Boland, CT. Issued/Filed: 24 April 2003/20 May 1999.

Nanosized YSZ Powders

Process for Making Nanosized Stabilized Zirconia. This process produces stabilized zirconia from a solution of zirconium salt and a stabilizing agent. The zirconium salt may include zirconium oxysulfate, zirconium oxychloride, zirconium oxynitrate, zirconium nitrate, and other water-soluble zirconium salts. The stabilizing agent may include calcium, magnesium, yttrium salts of oxides and rare earth oxides. The process is conducted by evaporation of the solution above the boiling point of the solution but below the temperature where there is significant crystal growth. The evaporation step is followed by calcination to produce the desired nanosized structure. Further processing by sintering may be applied to produce solid structures or by milling and classification to produce material for thermal spray coating.

US20030086865A1. B.J. Sabacky and T.M. Spitler, Fernley, NV. Issued/Filed: 8 May 2003/2 Nov 2001.

Nickel Powder

Nickel Powder and Process for Preparing the Same. A nickel powder characterized by having at least part of the surface thereof a layer of a composite oxide represented by the formula: $A_xB_yO_{(x+2y)}$, wherein A stands for at least one element selected from the group consisting of calcium, strontium, and barium; B stands for at least one element selected from the group consisting of titanium and zirconium; and x and y represent numbers satisfying the formula: $0.5 \leq y/x$ 4.5, wherein the ratio of each A and B to oxygen may involve an insufficiency of oxygen, and which may be doped with oxides of elements selected from manganese, magnesium, vanadium, tungsten, and rare-earth elements.

EP0916438B1. E. Asada, Y. Akimoto, K. Nagashima, H. Yoshida, and Y. Ma.

Company: Shoei Chemical Inc. Issued/Filed: 14 May 2003/6 March 1998.

Rare Earth Powder

Method for Thermal Spray Coating and Rare Earth Oxide Powder Used Therefor. The invention discloses an efficient method for the formation of a highly corrosion- or etching-resistant thermal spray coating layer of a rare earth oxide or rare earth-based composite oxide by a process of plasma thermal spray method by using a unique thermal spray powder consisting of granules of the oxide. The thermal spray granules are characterized by a specified average particle diameter of 5 to 80 μm with a specified dispersion index of 0.1 to 0.7 and a specified BET specific surface area of 1 to 5 m^2/g as well as a very low content of impurity iron not exceeding 5 ppm by weight as oxide. The flame spray powder used here is characterized by several other granulometric parameters including globular particle configuration, particle diameter D_{90}, bulk density, and cumulative pore volume.

US6576354. T. Tsukatani, Y. Takai, and T. Maeda. Company: Shin-Etsu Chemical Co. Ltd., Japan. Issued/Filed: 10 June 2003/29 June 2001.

WC and CrC Powders

Thermal Spray Powder of Tungsten Carbide and Chromium Carbide. A thermal spray powder is formed as a mixture of tungsten carbide granules and chromium carbide granules. The tungsten carbide granules each consists essentially of tungsten carbide bonded with cobalt, and the chromium carbide granules each consists essentially of chromium carbide bonded with nickel-chromium alloy. The powder may be as mixed with self-fluxing alloy powder. The powder preferably is sprayed with a high-velocity oxy-fuel thermal spray gun.

CA2136147C. B.E. Dulin, US. Issued/Filed: 13 May 2003/18 Nov 1994.

Spray Methods

Article Forming

Method of Making Articles from Composite Materials. Aeronautical and space engineering. Invention relates to production of articles from composite materials, for instance, mirror of space radio telescope. Proposed method of manufacture of articles from composite material includes assembling of pack by placing layers of reinforcement material impregnated with thermosetting binder, forming of article by hardening of binder and application of metal coating onto working surface of article by plasma deposition in air. Surfaces of article are prepared for deposition of metal coating by introduction of filtering cloth layer into pack of reinforcement material layers. Said cloth is placed on working surface of article and is removed after forming of article just before deposition of coating material. Results include increased adhesive strength, reduced time, simplified process of manufacture, provision of safety in operation, and reduced cost of production.

RU2201871C1. V.F. Simonov, F.F. Urmansov, V.E. Bitkin, A.V. Denisov, and M.A. Vladimirova, Russia. Issued/Filed: 10 April 2003/26 July 2001.

Corrosion- and Wear-Resistant Coatings

Process for Producing a Corrosion- and Wear-Resistant Layer by Thermal Spraying

EP1133580B1. E. Lugscheider. Company: Joma Chemical AS. Issued/Filed: 2 May 2003/25 Nov 1999.

Cold Spraying

Method and Device for Continuous Cold Plasma Deposition of Metal Coatings

EP1313889A1. P. Vanden Brande and A. Weymeersch. Company: Cold Plasma Applications C.P.A. Issued/Filed: 287 May 2003/23 Aug 2001.

Graded Coatings

Process for Producing Graded Coated Articles. The invention relates to a novel thermal spray process for the deposition of coatings with a graded or layered composition and the coated articles produced thereby. More particularly, the invention relates to feeding mixtures of coating materials to a thermal spray device and continuously or intermittently changing the composition of the deposited coatings by changing the thermal spray operating parameters. The continuous or intermittent change in the composition of the coating material during deposition creates a graded or layered coating structure.

US20030064234A1. W.A. Payne, M.W. Vickrey, and A.J. Stavros. Issued/Filed: 3 April 2003/28 Oct 2002.

Spray Forming

Methods and Apparatus for Spray Forming, Atomization and Heat Transfer

EP1296772A1. R.M. Forbes Jones, R.L. Kennedy, W. Conrad, H.G. Conrad, R.S. Phillips, A.R.H. Phillips, and T. Szylowiec. Company: ATI Properties Inc. Issued/Filed: 2 April 2003/18 June 2001.

Spray Masks

Making and Using Thermal Spray Masks Carrying Thermoset Epoxy Coating. A method of making a mask assembly, comprising: (a) providing a heat-resistant mask substrate having an exposed surface with a smoothness of less than 50.8 μm (2000 μin.); (b) uniformly spraying a thermoset epoxy organic coating onto said surface in one or more layers to provide a coating having a smoothness (R_a) of less than 1.5 μm and being devoid of pores that exceed about 0.0127 cms (0.005 in.) in size; and (c) flame polishing all or a portion of the coating to effect a surface finish of about 1.0 μm (R_a).

EP0984073B1. P.E. Pergande, J.A. Kinane, D.R. Pank, and D.R. Collins. Company: Ford Global Technologies Inc. Issued/Filed: 14 May 2003/27 Aug 1999.

Substrate Preparation

Method for Manufacturing a Thermally Sprayed Layer. With the method for manufacturing a thermally sprayed layer on a substrate, in particular a ceramic coating is applied to a metallic body. The sprayed layer is applied to a structured surface of the substrate. The surface structure of the substrate is produced by material removal by means of a high-pressure liquid jet. A removal point is thereby moved under control on the substrate while producing a macrotopography, namely by moving the liquid jet and/or the substrate. A groovelike removal track is produced by the material removal, which can be in a straight line or curved and which has a microtopography. A macroprofile of the macrotopography is manufactured by placing a plurality of removal tracks next to one another and by partial overlapping of these removal tracks. This macroprofile is coarser at least by a factor of 10 than a corresponding microprofile of the microtopography, elevations of the macroprofile have different heights and the microprofile is in particular quasi-fractal.

US20030077434A1 and EP1304395A1. F. Jansen, R. Damani, and W. Straub, Oberstammheim, Switzerland. Issued/Filed: 24 April 2003/17 Oct 2002.

Thermal Spraying

Method and System for Thermal Spraying. A method and a system for thermal

spraying capable of softening or melting spraying powder fed from a feeding machine to a thermal spraying machine through a connection pipe and spraying the powder from the thermal spraying machine, the method comprising the steps of sucking the thermal spraying powder stored in the feeding machine to the suction end of the connection pipe by reducing an atmospheric pressure in the connection pipe to a negative one relative to an atmospheric pressure in the connection pipe near the suction end, transferring the thermal spraying powder sucked to the suction end of the connection pipe to the delivery end of the connection pipe and leading into a tubular air stream injected from an injection port provided in the thermal spraying machine or leading into a combustion chamber provided in the thermal spraying machine or an injection nozzle, and softening or melting and spraying the powder.

WO3033756A1. T. Itsukaichi and S. Osawa. Company: Fujimi Inc., Aichi, Japan. Issued/Filed: 24 April 2003/15 Oct 2002.

Wire-Arc Spraying

Method and Device for Thermal Spraying for the Coating of Surfaces. The method for thermal spraying, especially of metals, for the coating of surfaces, wherein the material employed for coating is supplied in the form of a wire, molten and sprayed, uses a plasma arc.

US20030099779A1. D. Kley. Company: Grillo-Werke AG, Duisburg, Germany. Issued/Filed: 29 May 2003/19 Jan 2003.

Spray Systems

Arc Spray Gun

Arc Thermal Spray Gun and Gas Cap Therefore. An arc spray gun has a pair of tubular wire guides that guide two metal wires to a point of contact at the wire tips where an arc current through the wires effect an arc, thereby melting the tips. Primary gas channeling on a central axis issues a primary gas flow that atomizes the molten metal and effects a spray stream thereof. A gas cap has at least four orifices accurately spaced equally about the central axis. The orifices direct secondary gas jets inwardly with a forward directional component toward a point of intersection of the orifice axes on the central axis. The point of intersection is located proximate the point of contact and spaced downstream there from sufficiently for the jets not to interfere substantially with the atomization. The spray stream thereby is constricted and accelerated by the secondary gas jets.

EP0938932A3. R. Benary, R. Böhm, and L. Dirmeier. Company: Sulzer Metco (U.S.) Inc. Issued/Filed: 21 May 2003/4 Feb 1999.

Spraying Cylinders

Thermal Spraying System for Cylinder. A thermal spraying system for a cylinder, in which a cylinder is held on a turntable; a bore inside surface of said cylinder is subjected to thermal spraying by moving a thermal spraying gun in the axial direction in the bore of said cylinder while said cylinder is rotated; a suction port of a dust discharge pipe for sucking dust in the bore of said cylinder is disposed under said cylinder to suck and discharge dust in the bore of said cylinder; and the diameter of the suction port of said dust discharge pipe is larger than the inside diameter of the bore of said cylinder.

US6569242. K. Miyai, S. Kunioka, T. Takahashi, M. Suzuki, and H. Ohishi. Company: Suzuki Motor Corp., Hamamatsu, Japan. Issued/Filed: 27 May 2003/21 June 2001.

Thermal Barrier Coatings

Aluminizing Process for Plasma-Sprayed Bond Coat of a Thermal Barrier Coating System. A thermal barrier coating system and a method for forming the coating system on an article designed for use in a hostile thermal environment. The method is particularly directed to a coating system that includes a plasma sprayed MCrAlY bond coat on which a thermal-insulating APS ceramic layer is deposited, in which the oxidation resistance of the bond coat and the spallation resistance of the ceramic layer are substantially increased by vapor phase aluminizing the bond coat. The bond coat is deposited to have a surface area ratio of at least 1.4 and a surface roughness of at least 300 μin. R_a in order to promote the adhesion of the ceramic layer. The bond coat is then overcoat aluminized using a vapor phase process that does not alter the surface area ratio of the bond coat. This process is carried out at relatively low temperatures that promote inward diffusion of aluminum relative to outward diffusion of the bond coat constituents, particularly nickel and other refractory elements. The process conditions also provide sufficient vapor phase activity at the surface of the bond coat that promote aluminum atomic movement through the bond coat.

US6555179. J.D. Reeves, B.K. Gupta, and N.N. Das. Company: General Electric Co., Schenectady, NY. Issued/Filed: 29 April 2003/17 March 2000.

Ceramic Thermal Barrier Containing Hafnia. A ceramic thermal barrier coated on a substrate is characterized in that the coating comprises a stabilized zirconia coating including yttria and hafnia wherein the hafnia is present in an amount of at least about 15 wt.% to substantially reduce thermal conductivity of the thermal barrier coating. The coating may be produced by an electron beam physical vapor deposition method. A bond coat may be present between the substrate and said coating. The substrate may be a superalloy gas turbine engine blade or vane.

GB2383339A. K.S. Murphy. Company: Howmet Research Corp. Issued/Filed: 25 June 2003/23 Dec 2002.

Fabrication of an Article Having a Protective Coating With a Flattened, Preoxidized Protective Coating Surface. An article protected by a thermal barrier coating system is fabricated by providing an article substrate having a substrate surface, and thereafter producing on the substrate surface a protective coating having a polished, preoxidized protective coating surface. The protective coating is produced by depositing the protective coating on the substrate surface, the protective coating having a protective coating surface, thereafter polishing the protective coating surface, and thereafter controllably oxidizing the protective coating surface. The protective coating surface may optionally be controllably roughened by grit blasting after polishing and before controllably oxidizing. A thermal barrier coating may be deposited overlying the polished, preoxidized protective coating surface.

US6565672 and US656067. I. Spitsberg and R. Darolia. Company: General Electric Co., Cincinnati, OH. Issued/Filed: 20 May 2003/31 Aug 2001.

Low Thermal Conductivity Thermal Barrier Coating System and Method Therefore. A multilayer thermal barrier coating (TBC) having a low thermal conductivity that is maintained or even decreases as a result of a postdeposition high-temperature exposure. The TBC comprises an inner layer and an insulating layer overlying the inner layer. The inner layer is preferably yttria-stabilized zirco-

nia (YSZ), while the insulating layer contains barium strontium aluminosilicate (BSAS). After deposition, the TBC is heated to a temperature and for a duration sufficient to cause a decrease in the thermal conductivity of the BSAS-containing layer and, consequently, the entire TBC.

US6548190. I. Spitsberg and A.B. Nagaraj. Company: General Electric Co., Schenectady, NY. Issued/Filed: 15 April 2003/15 June 2001.

Method for Improving the Oxidation-Resistance of Metal Substrates Coated With Thermal Barrier Coatings. A method for providing a protective coating on a metal-based substrate is disclosed. The method involves the application of an aluminum-rich mixture to the substrate to form a discontinuous layer of aluminum-rich particles, followed by the application of a second coating over the discontinuous layer of aluminum-rich particles. Aluminum diffuses from the aluminum-rich layer into the substrate and into any bond coat layer that is subsequently applied. Related articles are also described.

US6562483. A.M. Thompson, D.M. Gray, and M.R. Jackson. Company: General Electric Co., Niskayuna, NY. Issued/Filed: 13 May 2003/4 Jan 2002.

Method for Preparing an Article With a Hafnium-Silicon-Modified Platinum-Aluminide Bond or Environmental Coating. An article such as a gas turbine blade or vane has a superalloy substrate and a coating system deposited on the substrate. The coating system includes a protective layer overlying the substrate, and, optionally, a ceramic thermal barrier coating layer overlying the bond coat. The protective layer has an uppermost layer with a composition including platinum, aluminum, and, in atom percent, from about 0.14 to about 2.8% Hf and from about 2.7 to about 7.0% Si, with the atomic ratio of silicon:hafnium being from about 1.7:1 to about 5.6:1.

US6582772. J.D. Rigney, R. Darolia, and W.S. Walston. Company: General Electric Co., Schenectady, NY. Issued/Filed: 24 June 2003/30 Sept 2002.

Nickel Aluminide Coating and Coating Systems Formed Therewith. A protective overlay coating for articles used in hostile thermal environments, and particularly for use as a bond coat for a thermal barrier coating deposited on the coating. The coating is predominantly beta-phase NiAl into which a platinum-group metal is incorporated, yielding a coating system capable of exhibiting improved spallation resistance as compared to prior bond coat materials containing platinum, must notably the platinum aluminide diffusion coatings. A preferred composition for the beta-phase NiAl overlay coating further contains chromium and zirconium or hafnium.

EP1321541A2 and EP1321541A2. R. Darolia, J.D. Rigney, and J.A. Pfaendtner. Company: General Electric Co. Issued/Filed: 25 June 2003/20 Dec 2001.

Thermal Barrier Coating Ceramic Structure

EP1038051B1. G.H. Marijnissen, A.H.F. Van Lieshout, G.J. Ticheler, H.J.M. Bons, and M.L. Ridder. Company: Sulzer Metco Coatings B.V. Issued/Filed: 25 June 2003/9 Dec 1998.

Thermal Barrier Coating System With Improved Aluminide Bond Coat and Method Therefore. A method for improving the thermal fatigue life of a thermal barrier coating (TBC) deposited on an aluminide bond coat through a process by which the surface morphology of the aluminide bond coat is modified to eliminate or at least reduce oxidation and oxidation-induced convolutions at the alumina-bond coat interface, as explained more fully below. The bond coat is deposited to have generally columnar grains and grain-boundary ridges at its surface, and is then peened at an intensity sufficient to flatten at least some of the grain boundary ridges, but insufficient to cause recrystallization of the bond coat when later heated, such as during deposition of the thermal barrier coating. In so doing, the original surface texture of the bond coat is altered to be smoother where the grain boundaries meet the bond coat surface, thereby yielding a smoother bond coat surface where the critical alumina-bond coat interface will exist following oxidation of the bond coat.

US6572981. I.T. Spitsberg. Company: General Electric Co., Schenectady, NY. Issued/Filed: 3 June 2003/16 Jan 2002.